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PATENT SPECIFICATION

665,935

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No. 13284/49

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COMPLETE SPECIFICATION

Method and Apparatus for Forming Tubular Articles

We, AMERICAN VISCOSE CORPORATION, of 1617, Pennsylvania Boulevard, Philadelphia 3, Pennsylvania, United States of America, a Corporation organised and existing under the laws of the State of Delaware, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the production of a continuous tubular article from a flat sheet. It is particularly concerned with the production of tubes of paper for wrapping wound packages of textile materials, such as rayon "cakes," cones, or the like, preparatory to liquid treatment of such wound packages. However, it is applicable as well to the formation of tubes from a sheet or web of paper, textile fabrics, metal foils, or other flexible materials for any use or purpose whatsoever.

The present invention consists of a method of and apparatus for forming a tubular article from a permeable, flexible fibrous sheet of indefinite length consisting of the steps of continuously delivering the sheet from a supply thereof longitudinally through a path, continuously and gradually deflecting the lateral edges from a flat position as they pass along the path to continuously lap one lateral edge of the continuously moving sheet over the opposite lateral edge thereof, providing concurrently with the overlapping of the edges a controlled amount of adhesive material to join the overlapped edges by continuously drawing a strip consisting of thermosensitive material between the overlapped edges, and then continuously and concurrently joining the overlapped edges by subjecting the overlapped edges with the strip therebetween to heat and pressure, all of the steps of overlapping, drawing the strip between the overlapped edges, and joining being performed in immediate sequential order.

The accompanying drawings illustrate one example of carrying the invention into effect.

In the drawing:—

Figure 1 is a plan view of the apparatus;

Figure 2 is a cross-section on line 11—11 of Figure 4;

Figure 3 is a side elevation; and

Figure 4 is a bottom view of one of the guiding elements of the apparatus of Figure 1.

As shown in Figures 1 and 3, the apparatus comprises a supply roll 2 for a continuous sheet of the flexible material to be formed into a tube, which, in the specific instance herein described, happens to be paper. From the supply roll, the paper 3 passes between slitting mechanism which may comprise two rolls 4 and 5, one or both of which is provided with suitably arranged knives 6 to slit the paper longitudinally with parallel rows of slits 7, so that those in any one row are offset from those in the next adjacent row. The rolls 4 and 5 may be driven by means (not shown) suitably synchronised with the take-up.

The paper sheet 3 passes over the controlling guide 8 (more particularly shown in Figures 2 and 4) and into the forming guide 9 into which the guide 8 partially extends generally concentrically but spaced from the internal surface a sufficient distance to form an annular passage for the flexed sheet. The forming guide 9 is supported by the bracket 10 and is of substantially cylindrical shape except at its entrance, which is flared outwardly. The guide 8 which has a broken periphery throughout its length is supported by the bracket 11 and has a portion 12 of one edge lapped over but spaced from the opposite inturned edge portion 13. Beyond the edge portion 12, this edge is cut away as at 14 and the edge portion 13 gradually flares outwardly, so that the guide 8 has a substantially cylindrical cross-section at line A—A of Figure 4. At the bottom of the exit ends of the guides 8 and 9 there are provided slots 15 and 16 respectively.

A heated rotatable drum or roll 17 is mounted in proximity with the aligned slots 15 and 16, and a pressure roll 18 rides on top of the drum 17, being supported by a pivoted arm 19 urged downwardly by the spring 20.

A thread or narrow strip 21 of thermosensitive material passes through a tension device 22 and a guiding pulley 23 and be-

[*Price* 2/-]

tween the overlapped edge portions of the flexible sheet as shown in Figure 3, until it finally passes between the rolls 17 and 18 where the heat and pressure render it adhesive to bond the overlapped edges of the sheet 3, thereby forming the tube 3A which proceeds under a bail or rod 24 in flattened form and to the take-up 25 which may be rotated by any suitable means (not shown).

While the apparatus as shown includes the slitting device 4—5, this may be omitted entirely, or it may be arranged between the discharge side of the guides 8 and 9 and the take-up 25. For certain purposes it may be desired to replace such means with a perforating means.

The thread or strip 21 may be composed of any material thermoplastic or even thermosetting, if still in thermoplastic condition, which is rendered adhesive by heating. Examples of such materials include the vinyl resins, particularly those of polyvinyl chloride with vinyl acetate or acrylonitrile, after-chlorinated vinyl polymers or co-polymers, polyvinylidene chloride; also acrylic and methacrylic acid ester resins, such as polymerised methyl methacrylate; nylons; cellulose derivatives, such as ethyl cellulose and so on.

The present invention has numerous advantages in that the messiness that accompanies the application of liquid adhesives is entirely avoided. The strip 21 is readily controlled reliably, so that it cannot escape from its relationship between the overlapped edge of the sheet to be bonded before its activation to an adhesive condition. In addition, the use of a narrow continuous thread or strip provides a simple way of controlling the amount of adhesive and the width of bonding layer in the product, which makes it possible to limit the change in liquid permeability of the bonded areas of the sheet to a minimum, or to control it to provide any predetermined change in permeability, depending upon the ultimate use to which the product is intended to be put.

The invention is of special advantage when applied to the production of liquid-permeable paper wrappers for wound cakes of rayon resulting from the collection of freshly spun filaments in centrifugal buckets. After the tubular wrapper is collected on the take-up 25, it needs merely to be cut to the desired length to provide the final wrapper of sleeve-like form.

It has also been found that the paper sheet, when slit, should be slit longitudinally of the grain of the paper, which should lie parallel to the axis of the tube. It has heretofore been the practice, whenever slitting of thin paper has been resorted to for any purpose, to orient the slits across the grain of the paper, because this had always been thought necessary to produce satisfactory products. Surprisingly, it has been found that, for the purpose of wrapping rayon cakes to protect the windings during liquid treatment, the slits should be made in the direction of the grain of the paper. Otherwise, it has been found, the development during liquid treatment of a tear extending between two adjacent rows of slits will rapidly extend progressively across several of the adjacent rows and frequently across the entire wrapper. Such tears do not grow in this fashion when the slits are oriented in the direction of the grain of the paper, but stop by the time they reach across the space between two adjacent rows of slits.

In the claims, the term "strip" is intended in a generic sense to comprehend monofilament or multifilament threads as well as ribbons or bonds of slight or considerable width. Similarly, "tubular" and "tube" is not to be restricted to a hollow cylindrical article, but may include a hollow article of any cross-section.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of forming a tubular article from a permeable, flexible, fibrous sheet of indefinite length consisting of the steps of continuously delivering the sheet from a supply thereof longitudinally through a path, continuously and gradually deflecting the lateral edges from a flat position as they pass along the path to continuously lap one lateral edge of the continuously moving sheet over the opposite lateral edge thereof, providing concurrently with the overlapping of the edges a controlled amount of adhesive material to join the overlapped edges by continuously drawing a strip consisting of thermosensitive material between the overlapped edges, and then continuously and concurrently joining the overlapped edges by subjecting the overlapped edge with the strip therebetween to heat and pressure, all of the steps of overlapping, drawing the strip between the overlapped edges, and joining being performed in immediate sequential order.

2. The method according to Claim 1 characterised in that said strip is a thread.

3. The method according to Claim 1 or 2, characterised in that said thermosensitive strip is continuously drawn under tension.

4. Apparatus for producing a tubular article from a flexible sheet by a method according to Claim 1, characterised by the provision of guide means arranged to lap one edge of said sheet over the opposite edge thereof, means for guiding a strip of said

thermosensitive material between said overlapped edges, and means for subjecting the overlapped edges with the strip therebetween to heat to render said thermosensitive material adhesive to bond the edges.

5. Apparatus according to Claim 4, characterised by means for drawing said sheet continuously through a path, said guide means for overlapping said edges being arranged along said path, said means for guiding said thermosensitive strip being arranged in advance of said first guide means, and said means for subjecting the overlapped edges to heat being arranged adjacent the discharge side of said guide means.

6. Apparatus according to Claim 4 or 5, characterised by means for tensioning said thermosensitive strip.

7. Apparatus according to Claim 5 or 6, characterised in that said means for subjecting the overlapped edges to heat are in substantial alignment with the strip-guiding means, and means for applying pressure to said overlapped edges is provided adjacent said heating means.

8. Apparatus according to any of Claims 5 to 7, characterised by means along said path for slitting said sheet.

9. Apparatus according to any of Claims 4 to 8, characterised in that said guide means for overlapping said edges comprises two generally concentric members having an approximately annular passage therebetween.

10. Apparatus according to Claim 9, characterised in that the inside member of said guide means has a broken periphery throughout its length and has a substantially cylindrical cross-section at a zone toward the discharge end thereof and has, at a zone in advance of the cylindrical portion, overlapping but spaced edge portions.

11. Apparatus according to any of Claims 4 to 10, characterised in that said heating means is rotatable.

12. Apparatus according to Claims 7 and 9, characterised in that said pressure means comprises pivotally mounted means extending through the inner concentric member for exerting pressure adjacent the point of heat application.

13. Apparatus according to any of Claims 4 to 12, characterised by means for winding the tubular article in flattened form.

14. Apparatus for producing tubular articles from flexible sheets substantially as described with reference to Figures 1 to 4 of the drawing.

Dated this 18th day of May, 1949.

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Agents for the Applicants.

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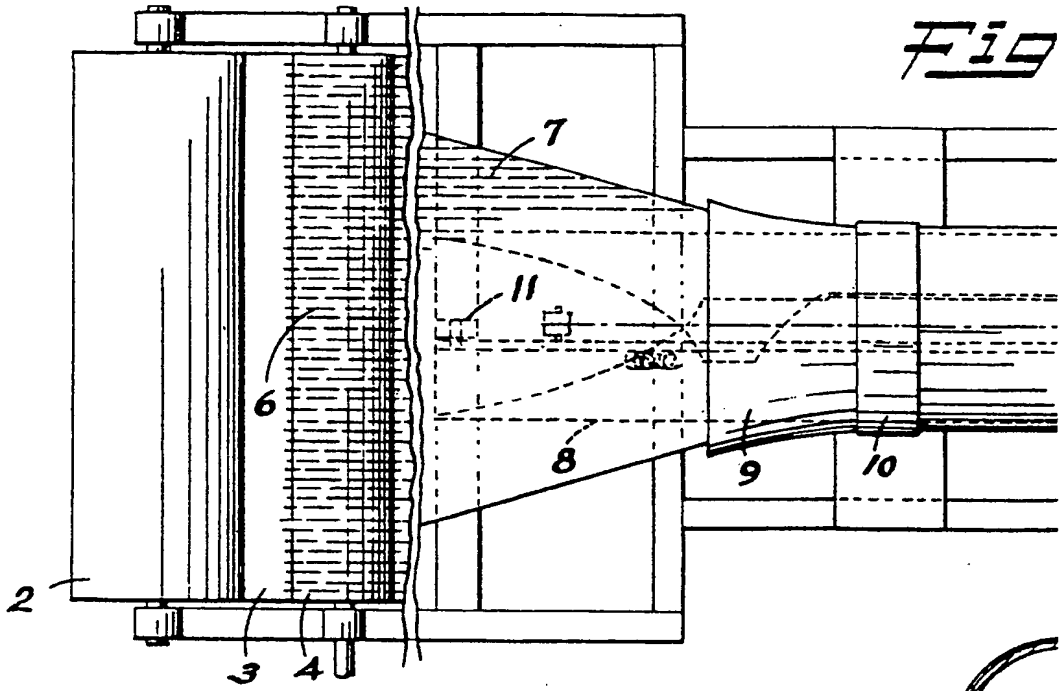


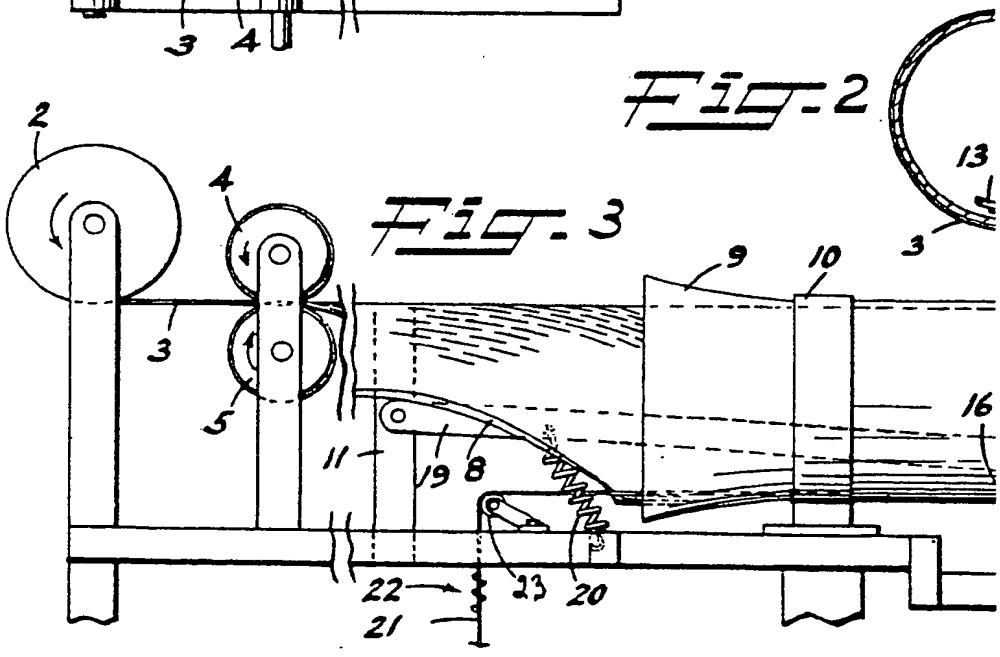


Fig-1

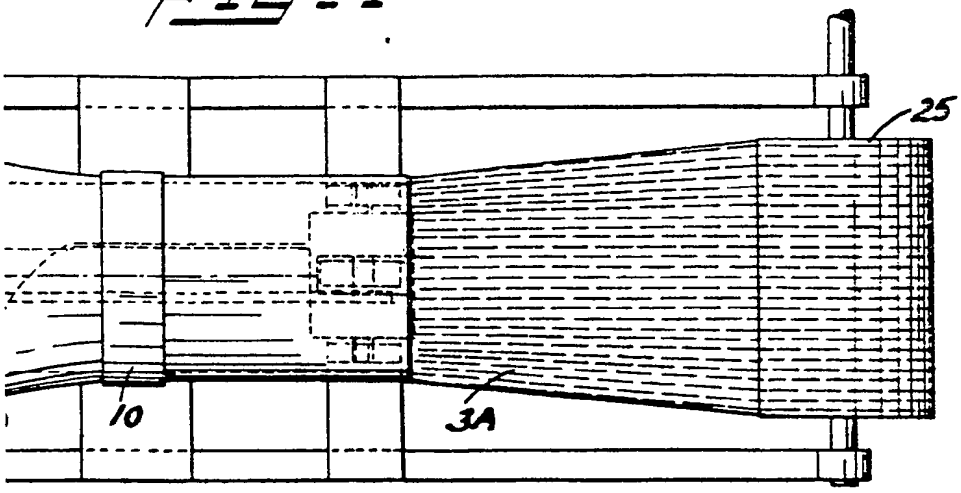
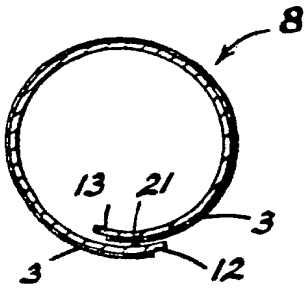


Fig-2



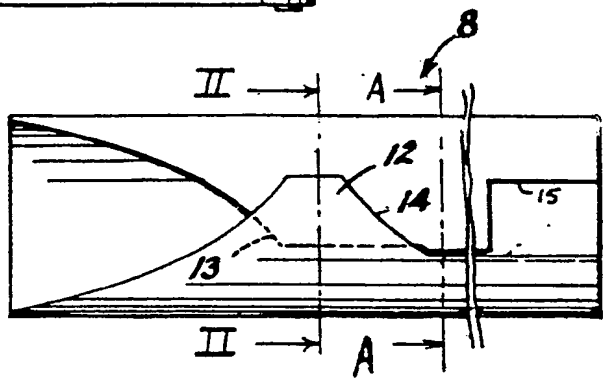


Fig-4

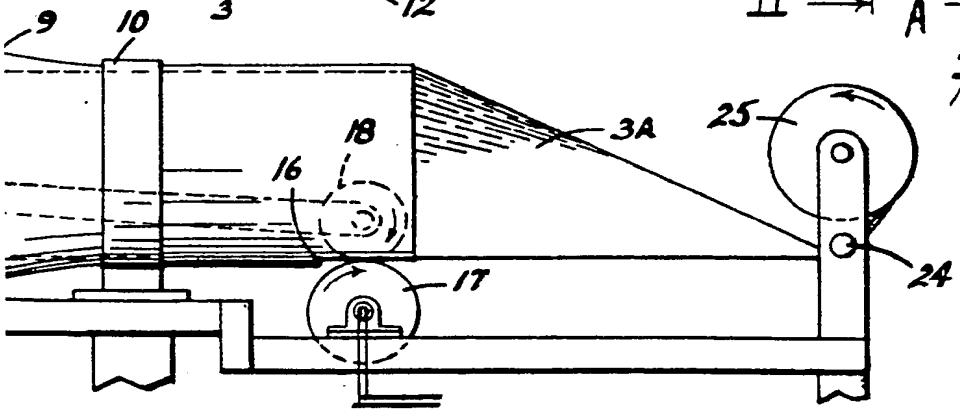


Fig-1

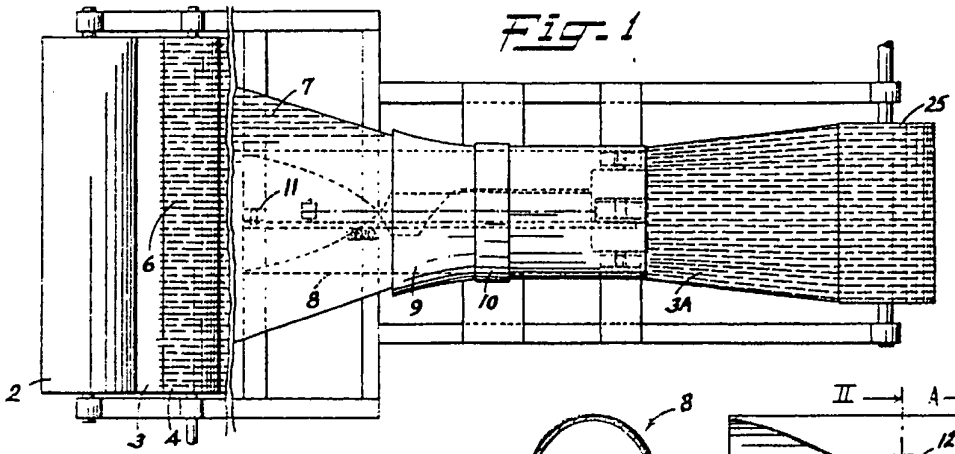
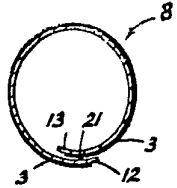


Fig-2



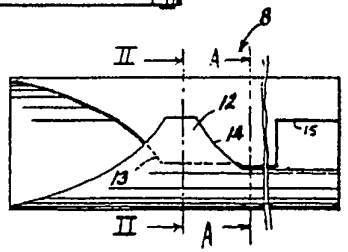


Fig-4

Fig-3

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